



# Surface decoration of silica nanoparticles by Pd(0) deposition for catalytic application in aqueous solutions

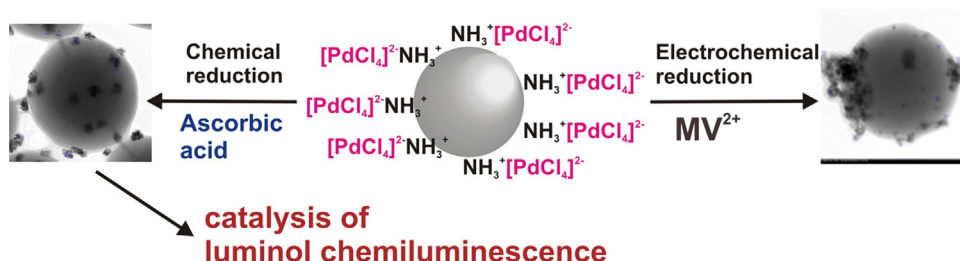


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## GRAPHICAL ABSTRACT



## HIGHLIGHTS

- Synthetic routes of Pd(0) deposition onto silica nanoparticles in water.
- Synthetic conditions for homogeneous Pd(0)/silica aqueous colloids.
- Size of deposited Pd(0) is optimized by synthetic procedure.
- Hybrid Pd(0)/silica nanomaterial catalyze chemiluminescence of luminol.

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## ABSTRACT

The work introduces chemical and electrochemical synthetic routes to obtain Pd(0) nanoparticles (PdNPs) deposited onto silica supports in aqueous media. The former route is performed through reduction of Na<sub>2</sub>[PdCl<sub>4</sub>] by ascorbic acid in the presence of amino-modified silica nanoparticles (SiO<sub>2</sub>-NH<sub>2</sub>). The time-dependent variation of pH and the reductant concentration is the simple synthetic route to get uniform deposition of 215 nm sized silica supports by Pd(0) nanoparticles (3–10 nm). The methylviologen mediated electrochemical synthetic route results in small PdNPs (3–9 nm) located both onto and beyond the silica supports. Thus, the chemical synthetic route provides more homogeneous Pd(0)-SiO<sub>2</sub>-NH<sub>2</sub> aqueous colloids. The results reveal that attractive interactions of amino/ammonium groups of SiO<sub>2</sub>-NH<sub>2</sub> with both [PdCl<sub>4</sub>]<sup>2-</sup> and ascorbate-stabilized Pd(0) seeds are the key reasons for the better Pd(0) deposition onto silica supports. The chemically deposited Pd(0)-SiO<sub>2</sub>-NH<sub>2</sub> nanoparticles catalyze the chemiluminescence of luminol resulted from the H<sub>2</sub>O<sub>2</sub>-facilitated oxidation in alkaline aqueous solution.

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